

MASS. EA24.202: T 66/997



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Massachusetts Department
of Environmental Protection
Bureau of Waste Prevention

1997

GOVERNMENT DOCUMENTS
COLLECTION

OCT 23 1999

**Toxics Use
Reduction
Information
Release**

University of Massachusetts
Depository Copy

March 23, 1999

Developed in Conjunction with

Office of Technical Assistance for Toxics Use
Reduction

Toxics Use Reduction Institute

Executive Office of Environmental Affairs



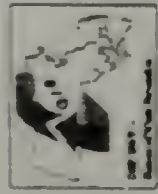
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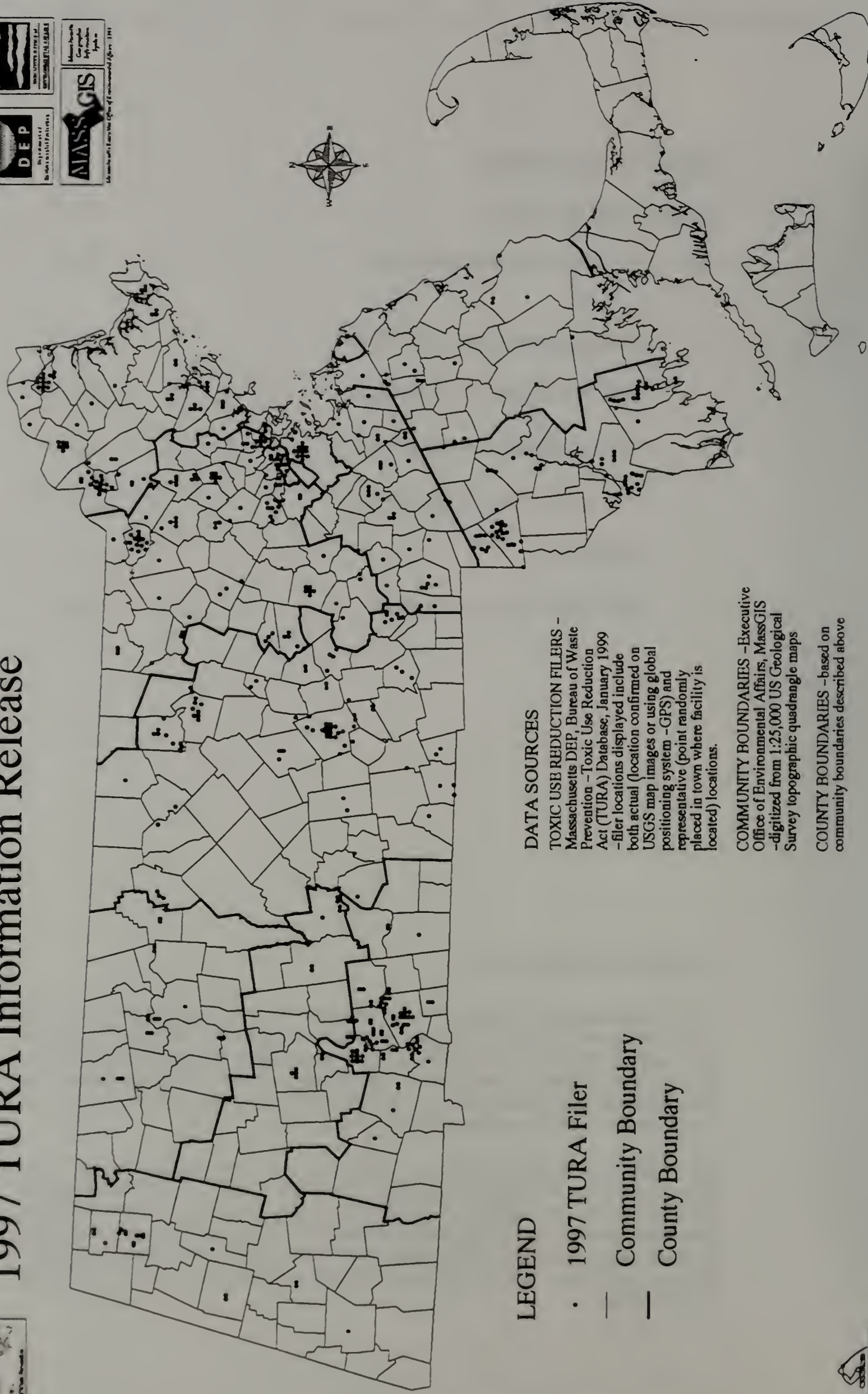
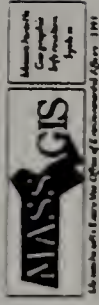
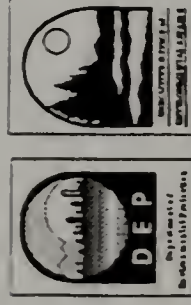
Acknowledgments

The "TURA Information Release Team" is comprised of Lynn Cain from the Department of Environmental Protection, Rich Bizzozero from the Office of Technical Assistance, and Elizabeth Harriman and Heather Tenney from the Toxics Use Reduction Institute at the University of Massachusetts Lowell. This Team manages oversight, public reporting and continuous improvement of toxics and pollution prevention information resources created by the Toxics Use Reduction Act (TURA).

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1997 TURA Information Release



LEGEND

• 1997 TURA Filer

— Community Boundary

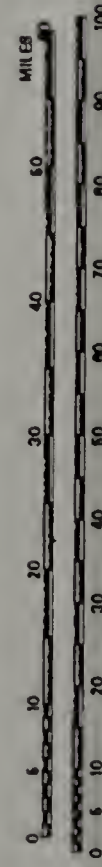
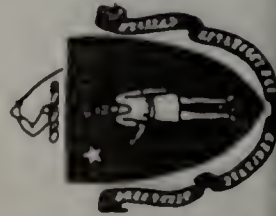
— County Boundary

DATA SOURCES

TOXIC USE REDUCTION FILERS -
Massachusetts DEP, Bureau of Waste
Prevention - Toxic Use Reduction
Act (TURA) Database, January 1999
-filer locations displayed include
both actual (location confirmed on
USGS map images or using global
positioning system - GPS) and
representative (point randomly
placed in town where facility is
located) locations.

COMMUNITY BOUNDARIES -Executive
Office of Environmental Affairs, MassGIS
-digitized from 1:25,000 US Geological
Survey topographic quadrangle maps

COUNTY BOUNDARIES -based on
community boundaries described above



March 23, 1999

1997 TURA Information Release

Introduction

In 1989, the Commonwealth of Massachusetts enacted the Toxics Use Reduction Act. The Toxics Use Reduction Act (TURA) was passed unanimously by the state legislature reflecting a strong spirit of cooperation between business and environmental interests. TURA established the Commonwealth of Massachusetts as a leader in environmental protection by declaring that the state's first priority is to prevent pollution at the source.

Toxics Use Reduction focuses on reducing the use of toxic chemicals or the generation of waste by improving and redesigning products and processes of production. Facilities may choose to reformulate products, redesign production processes, substitute less or non-toxic chemicals for known toxic chemicals, upgrade and improve production equipment, tighten up operations and maintenance, or recycle and reuse materials in production processes.

Over the past eight years, Massachusetts manufacturers have worked with government to implement this innovative program in environmental protection. The progress of Massachusetts industries in reducing toxic chemical use, waste, and emissions is significant.

To assist the reader in understanding some of the key TURA element, please refer to "Key TURA Terms" on Page 23.

Executive Summary

This report summarizes information from 509 Large Quantity Toxics Users who reported to the Massachusetts Toxics Use Reduction Program (TURA) during the 1997 calendar year. This report provides an overall analysis of eight years of TURA data and highlights toxics use reduction progress within the Core Group from 1990 through 1997. The Core Group consists of industries and chemicals that have been subject to yearly reporting since 1990 (*see page 6 for more information on Core Group qualifications*).

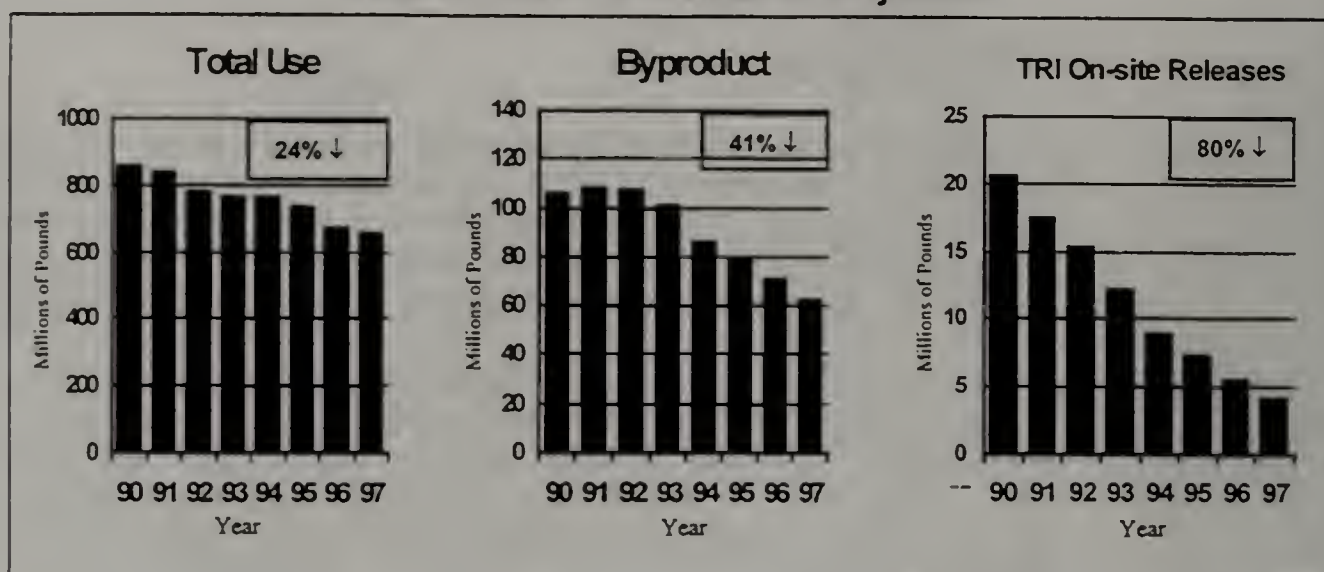
Changes in Production

Between 1990 and 1997 Core TURA filers reported an overall 32% increase in production. The TURA data is adjusted to eliminate the effects of changes in production using facility reported TRI production ratios.

Core Group Toxics Use Reduction Progress From 1990 to 1997 – Production Adjusted Data:

When the 1997 reported data has been adjusted for production, TURA filers have decreased their toxic chemical use by 24% from the 1990 base year to 1997. Using the same adjustment method (*see description on page 9*), TURA filers are generating less byproducts or waste per unit of production, TURA filers have been equally successful in reducing their releases of TRI reported on-site chemicals by 80% (*see Figure 1*).

Figure 1 – Core Group Toxics Use Reduction Progress From 1990 to 1997 – Production Adjusted



The Toxics Use Reduction Act had a stated 10-year goal of reducing the generation of toxic waste by 50% from the base year of 1987 to 1997. From 1990, the first reporting year, to 1997, there was a 41% reduction in production adjusted byproduct.

Core Group Reported 1997 TURA Data – Not Adjusted For Production:

Total chemical use increased from 770.9 million pounds in 1996 to 864.2 million pounds in 1997. Out of this 93 million pound chemical use increase, 88 million pounds can be attributed to 4 chemicals which were ranked in the top 20 chemicals used in 1997 (*see table 5 on page 14*). These 4 chemicals are styrene monomer, copper, sodium hydroxide, and methanol. Approximately 80 million pounds of the 93 million pound increase in chemical use can be attributed to facilities which appear on the top 20 facilities list for both 1996 and 1997 (*see Table 8 on page 20*).

Although the total chemical use increased from 1996 to 1997, byproduct generation remained relatively constant, increasing from 81.7 million pounds in 1996 to 82.4 million pounds in 1997. While total chemical use increased and byproduct generation remained relatively constant, on-site releases reported on the federal Toxics Release Inventory (TRI) have decreased from 6.4 million pounds in 1996 to 5.5 million pounds in 1997, a decrease of 14% (*see Table 1*).

Table 1 - 1996 to 1997 Reported Changes for Core Group

Year	Total Use (Lbs.)	Byproduct (Lbs.)	TRI On-Site Releases to the Environment (Lbs.)
1996	770,900,000	81,700,000	6,400,000
1997	864,200,000	82,400,000	5,500,000

Core Group Toxics Use Reduction Progress From 1990 to 1997

From 1990-1997, Massachusetts filers have increased their total use of reportable chemicals by 1% but reduced their byproduct generation by 22% from 106.2 million pounds in 1990 to 82.4 million pounds in 1997. Massachusetts filers were successful in reducing their TRI on-site releases by 73% from 20.6 million pounds in 1990 to 5.5 million pounds in 1997. These reductions, however, are NOT adjusted for production activity.

I. Measuring Progress Under TURA

TURA reporting information is used to measure progress of Massachusetts TURA filers in reducing their use of toxic materials and their generation of toxic byproducts.

The Table below summarizes the 1997 data for all filers in the system. Note that these companies reported using about 1.4 billion pounds of chemicals, of which 137 million pounds were generated as waste.

Table 2 – 1997 TURA and TRI Information

1,382,000,000 Lbs.	Total Use
137,000,000 Lbs.	Byproduct
631,000,000 Lbs.	Shipped in Product
58,000,000 Lbs.	TRI Transfers and Releases

To measure the progress made by 1997, information was analyzed all the way back to 1990, the first year of the program. In 1990, only manufacturing firms were required to report. Then, pursuant to the TURA statute, the reporting universe was expanded to include industries not traditionally considered manufacturers. The list of chemicals subject to reporting was expanded during reporting years 1991 through 1993. The expanded chemical list further enlarged the universe of companies reporting and reflects information that is not federally required under TRI (Toxics Release Inventory). In addition, over the years, certain chemicals have been delisted.

Figure 2 illustrates the changes in the number of chemicals reported over the past eight years. Out of 1,420 chemicals regulated under TURA, only 187 were actually reported in 1997. This compares to a high of 196 chemicals reported in 1996.

Figure 2 - TURA Filer Trends 1990 - 1997

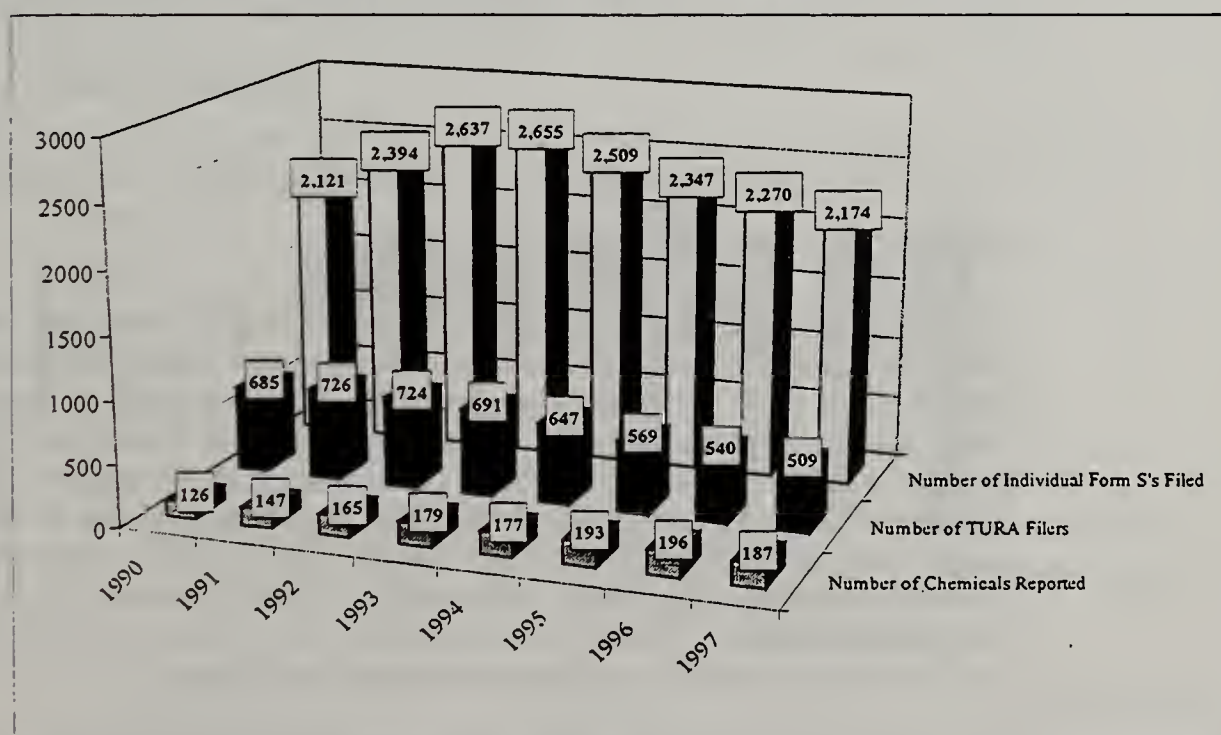
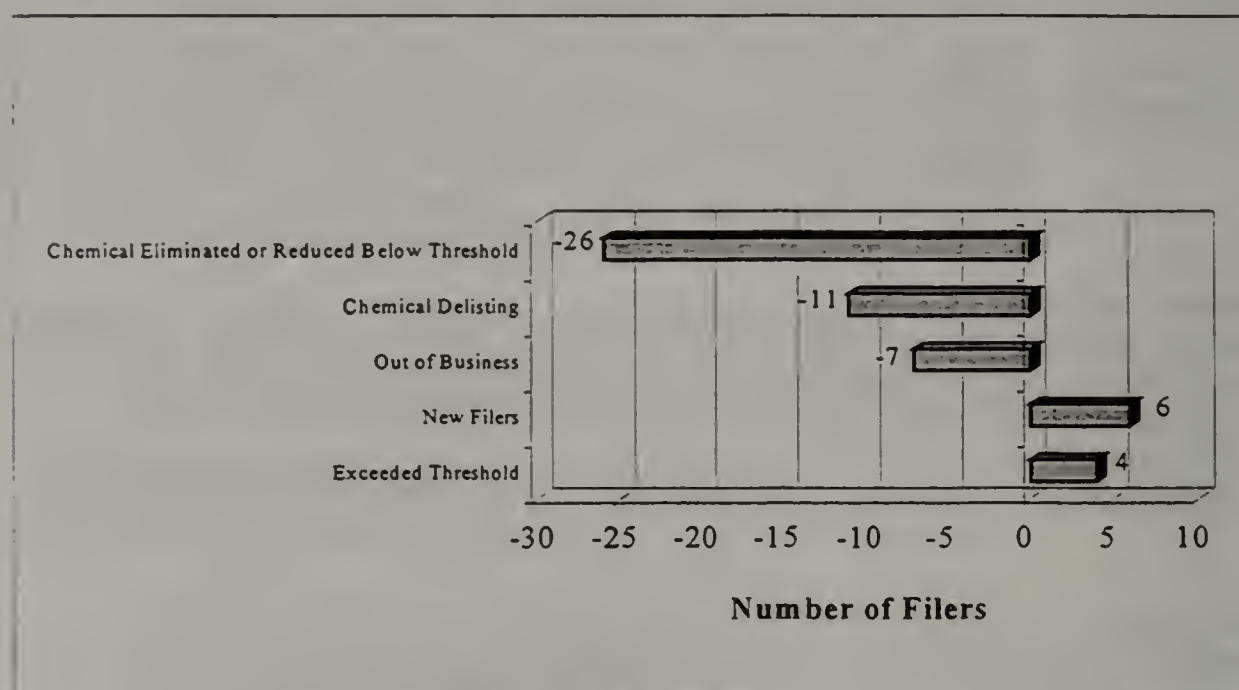


Figure 2 also shows the decline in the number of facilities reporting under TURA from a high of 726 firms in 1991 to 509 in 1997. Since 1991, 344 firms have left the TURA reporting universe, while 168 entered. However, as can be seen Table 3, the 168 new filers reported almost as much chemical use in terms of pounds as the 344 filers who left the system.

Table 3 - Changes in Filers Between 1990 and 1997

	<i>Leaving TURA Universe</i>	<i>Entering TURA Universe</i>
Number of Facilities	344	168
Quantity of Chemicals Reported	230,086,673 Lbs. (1990)	175,778,201 Lbs. (1997)

Figure 3 shows the reasons for new filers and filers who ceased reporting in 1997. The most predominant reason for filers to leave the reporting universe is elimination of the chemical or reduction of use below threshold, both often due to TUR. Significantly fewer filers left due to chemical delistings and even fewer are out of business. Filers entered the reporting universe for reasons such as new businesses or enforcement action. A slightly smaller number entered because they trip the reporting threshold.

Figure 3 – Filers Entering and Leaving Reporting Universe in 1997

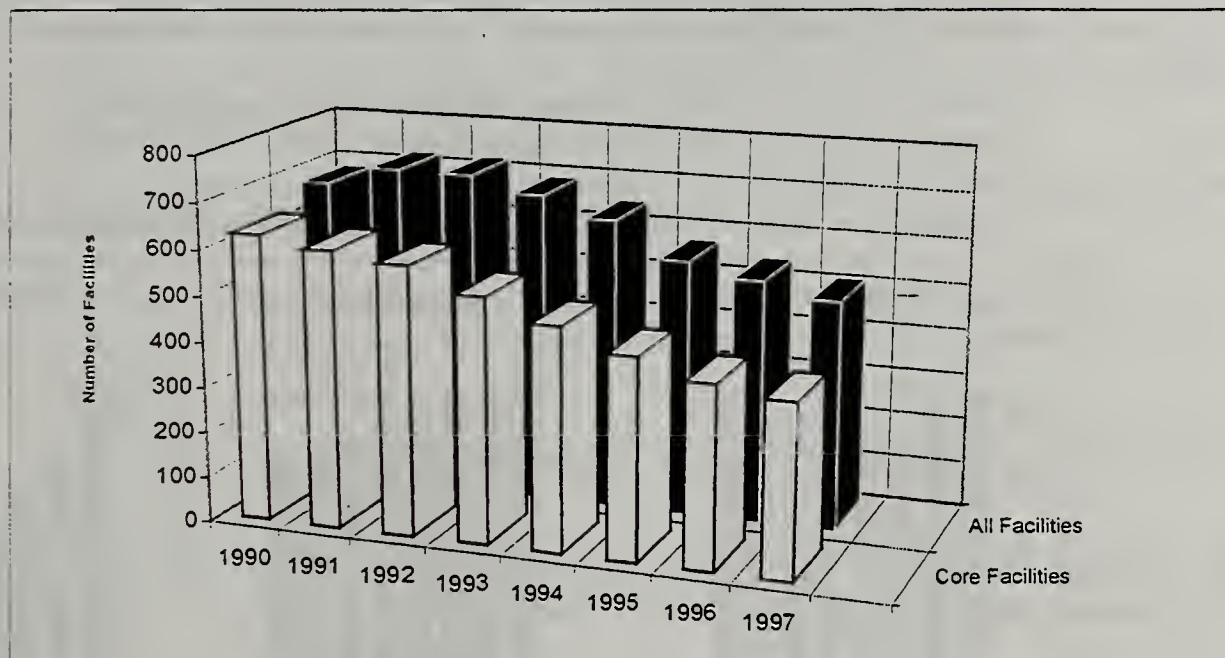
Measuring Core Group Progress

TURA data is used to measure progress of Massachusetts TURA filers in reducing their use of toxic materials and their generation of byproducts. Measuring progress is difficult when looking at all the information reported each year because of changes in what is required to be reported each year. In order to allow for a consistent picture of TUR progress, a group of records, called the Core Group, has been defined. The Core Group consists of industries and chemicals that were subject to reporting in 1990 and remain subject to reporting in 1997. For industries, the Core Group includes any facility whose Standard Industrial Classification (SIC) code is within the range of 20 to 39 (inclusive), the manufacturing SIC codes. For chemicals, the Core Group includes all chemicals in the 1990 TURA reporting list that have not since been delisted.

- ☐ The above qualifications for inclusion in the Core Group never change. However, there are yearly changes in the Core Group according to chemical delistings and new filers.
- ☐ If a chemical is delisted, it is removed from the Core Group for all reporting years.
- ☐ New filers are included in the Core Group if their SIC codes and chemicals qualify as core.

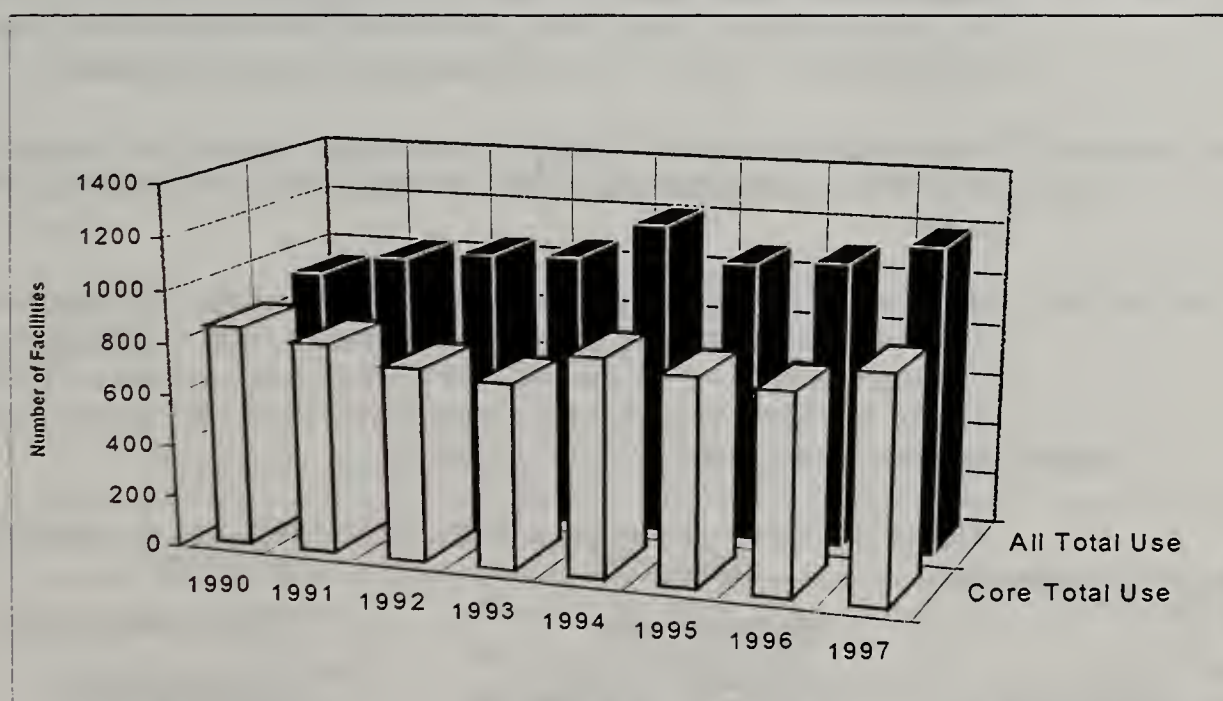
- If a core facility drops below the reporting threshold, its prior year records remain in the core.
- The Core Group does not include chemicals for which a facility claimed trade secret in any year.

Figure 4 – Number of Facilities: Core Group vs All TURA Filers



The Core Group, as shown in Figure 4 includes 378 or 74%, of the facilities reporting in 1997.

Figure 5 – Amount of Total Use: Core Group vs All TURA Filers



The Core Group used 864.2 million pounds or 73% of the total toxic chemicals reported in 1997 (see Figure 5).

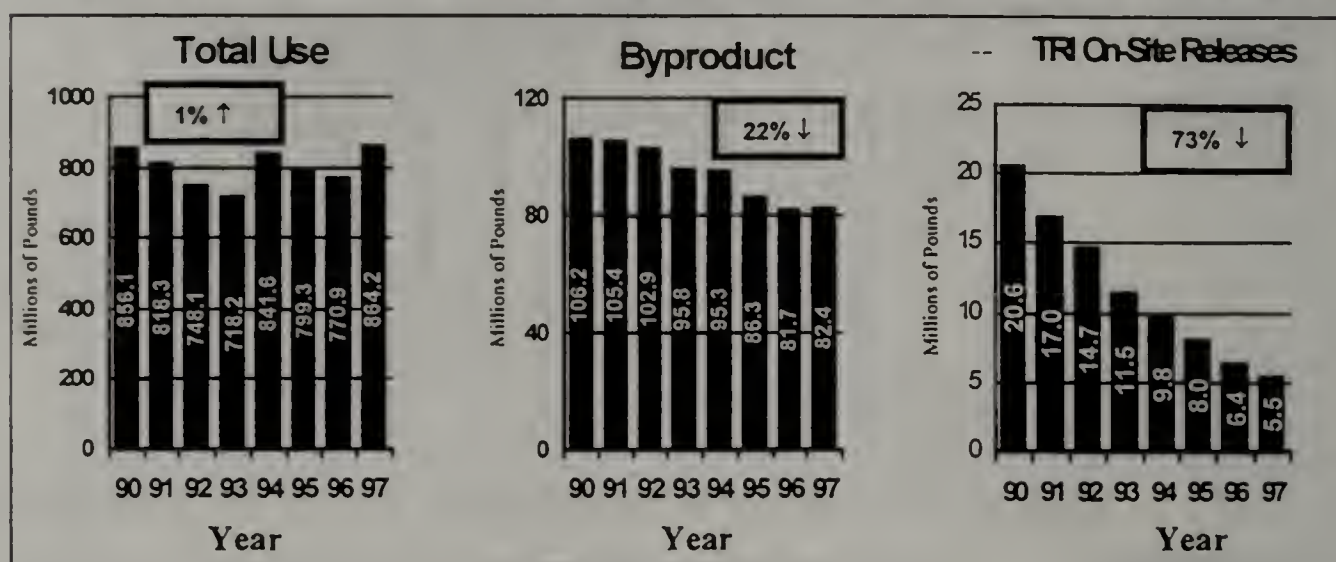
Reported Changes – Core Group

The changes in total reported Core Group quantities over the period 1990 to 1997 (unless otherwise noted) are shown in Figure 6 and Figure 7. Please note that a reported quantity is raw data, which has not been adjusted for changes in production.

From 1990 to 1997, Massachusetts Core Group TURA filers have increased their total use by 1%, from 856.1 million pounds in 1990 to 864.2 million pounds in 1997.

Filers have reduced their byproduct generation steadily since 1990 from a high of 106.2 million pounds to a low of 82.4 million pounds in 1997, a 22% reduction.

Figure 6 – Core Group Quantities 1990 –1997 (not production adjusted)

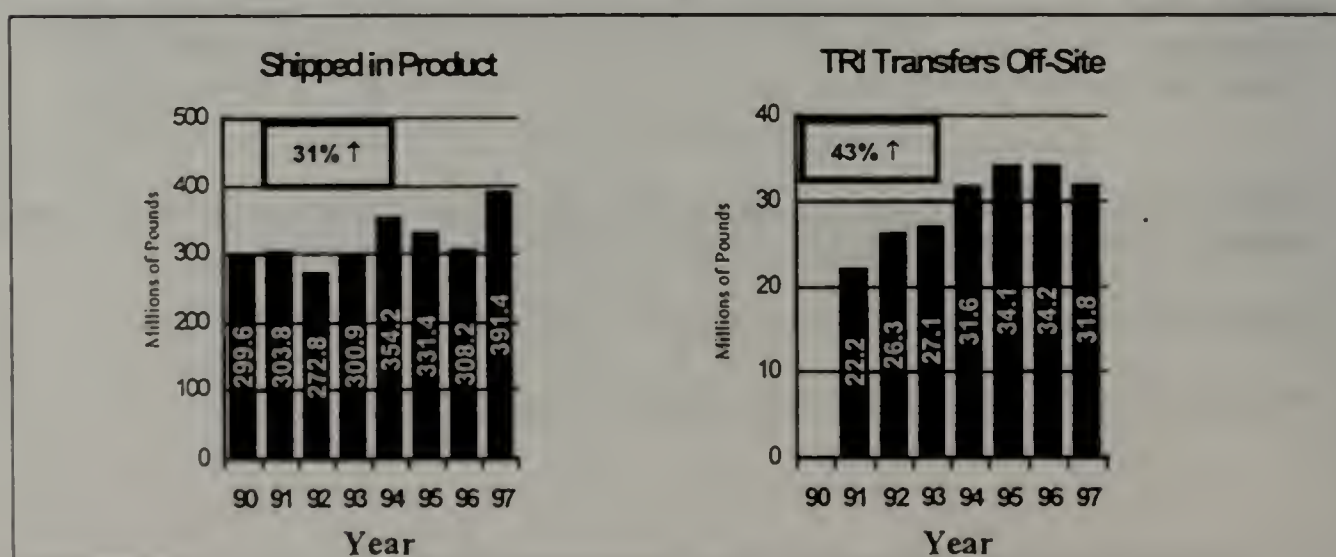


Massachusetts TURA filers have been very successful in achieving reductions in federal TRI On-Site Releases. Since 1990, these releases have been reduced from a high of 20.6 million pounds to a low of 5.5 million pounds in 1997, a 73% reduction.

The quantities of chemicals shipped in product has increased over the past 8 years, from a low of 272.8 million pounds in 1992 to a high of 391.4 million pounds in 1997, a 31% increase.

Since 1991, TURA filers have increased their TRI Transfers Off-Site from a low of 22.2 million pounds to a high of 34.2 million pounds in 1996, lowering slightly in 1997 to 31.8 million pounds. Over the 1991-1997 period there has been a 43% increase in TRI Transfers Off-Site (byproducts that are transferred off-site for energy recovery, recycling, treatment and disposal).

Figure 7 – Core Group Quantities 1990-1997 (not production adjusted)



Toxics Use Reduction Progress from 1990 to 1997 - Production Adjusted Data:

Production Ratio

From 1996 to 1997, production increased an average of 15% in Massachusetts. The increase in production from 1990 to 1997 represents a 32% increase in the overall change in production since the first reporting year.

The TURA data is adjusted to eliminate the effects of changes in production using the facility reported TRI production ratios.

The following example illustrates how data is adjusted to reflect changes in production:

Example

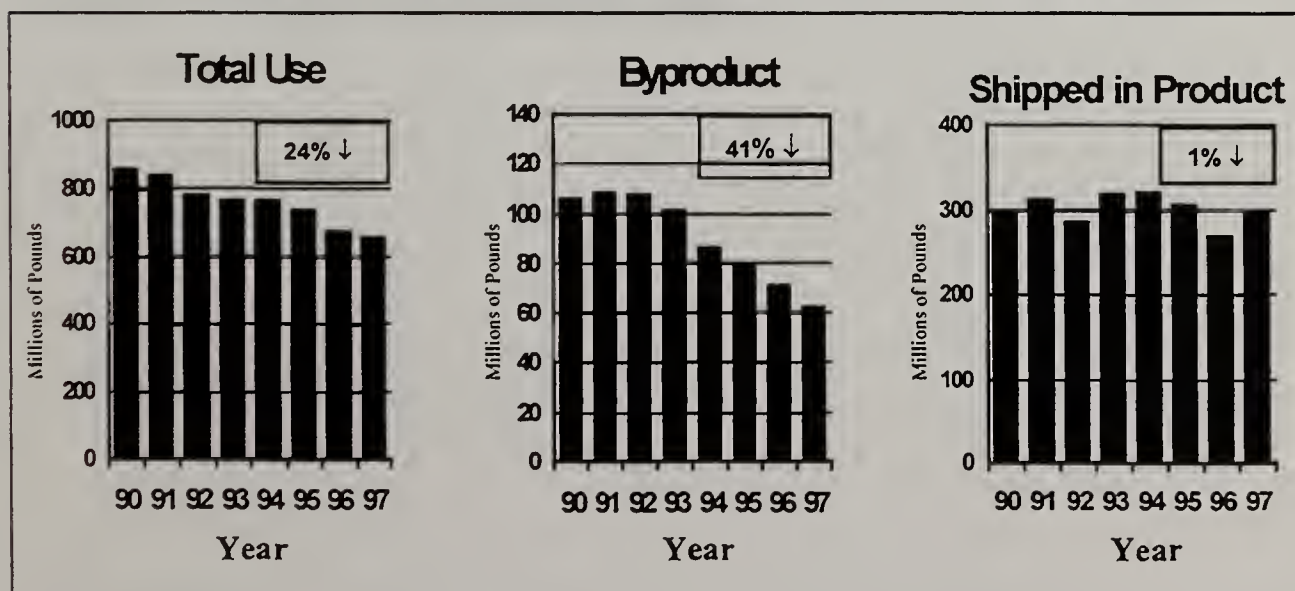
- A facility produces 1,000 machine parts, and generates 100 lbs. of byproduct in year 1.
- In year 2, it produces 25% more machine parts (1,250). Therefore, the TRI production ratio = 1.25. However, assume it still generates 100 lbs. of byproduct.
- The production adjusted byproduct for year 2 is $100 \text{ lbs.} / 1.25 = 80 \text{ lbs.}$
- The production adjusted percent change year 1 to year 2 is $[100 - 80] / 100 = 0.20$ or a 20% reduction, while its actual byproduct reduction is 0%.

Production Adjusted Changes

When the Core Group information is adjusted to account for changes in production (*see Figures 8 and 9*), Massachusetts TURA filers have reduced their toxic chemical use by 24%.

Since 1990, Core Group facilities are generating less byproducts. This reflects a reduction to date of 41% when adjusted for production.

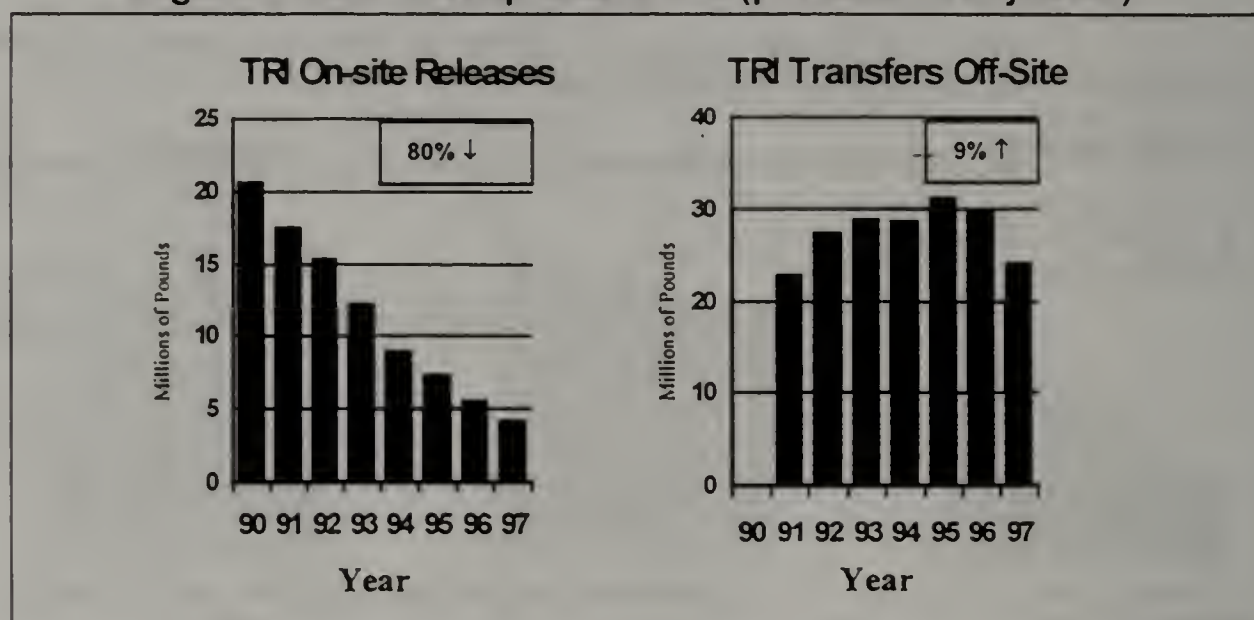
Figure 8 – Core Group Quantities (production adjusted)



Quantities of chemicals shipped in product have varied over the past years, a production adjusted reduction of 1% since 1990. The production adjusted quantity shipped in product corresponds with changes in production.

Massachusetts Core Group TURA filers have been very successful in reducing their generation of TRI On-Site Releases. These filers have reported a steady decline in TRI On-Site Releases of chemicals. This reflects a reduction of 80% over the past eight years.

Figure 9 - Core Group Quantities (production adjusted)



Over the past years TURA filers have increased their TRI Transfers Off-Site of chemicals, from a low of 22.2 million pounds in 1991 to a high of 31.3 million pounds in 1995. Since 1995, TURA filers have reduced their TRI Transfers Off-Site to 24.1 million pounds.

Table 4- Core TURA Data : 1990 - 1997 Trend Summary
 (Does Not Include Trade Secret Quantities)
 Quantities are in Millions of Pounds

	Total Use		Byproduct		Shipped In Product		TRI On-Site Releases To the Environment		TRI Transfers Off-Site		TRI Activity Index (1)
	Reported Quantity	Adjusted for Production	Reported Quantity	Adjusted for Production	Reported Quantity	Adjusted for Production	Reported Quantity	Adjusted for Production	Reported Quantity	Adjusted for Production	
1990	856.1	856.1	106.2	106.2	299.6	299.6	20.6	20.6	(2)	(2)	
1991	816.3	839.8	105.4	108.4	303.8	312.5	17.0	17.5	22.2	22.2	0.97
1992	748.1	782.2	102.9	107.6	272.8	285.2	14.7	15.3	26.3	27.4	0.98
1993	718.2	761.6	95.8	101.6	300.9	319.0	11.5	12.2	27.1	28.8	0.99
1994	841.6	762.8	95.3	86.4	354.2	321.0	9.8	8.9	31.6	28.7	1.17
1995	799.3	734.7	86.3	79.3	331.4	304.6	8.0	7.4	34.1	31.3	0.99
1996	770.9	671.0	81.7	71.1	308.2	268.2	6.4	5.6	34.2	29.8	1.06
1997	864.2	654.7	82.4	62.4	391.4	296.5	5.5	4.2	31.8	24.1	1.15
Percent Change 1990-1997	1% Increase ↑	24% Reduction ↓	22% Reduction ↓	41% Reduction ↓	31% Increase ↑	1% Reduction ↓	73% Reduction ↓	80% Reduction ↓	43% Increase ↑	9% Increase ↑	32% Increase ↑

- (1) A ratio of reporting production by comparing current year to prior year production (TRI).
- (2) TRI definition of Transfers Off-Site changed in 1991, thus 1990 is not shown. Quantities in shaded boxes are adjusted for changes in manufacturing activity (level of production) using the facility-reported TRI Production Ratio/Activity Index.

The "Core TURA Data: 1990-1997 Trend Summary" chart shows the **Reported** and **Adjusted for Production** Quantities for 1990 to 1997. The Adjusted for Production numbers eliminate the effects of changes in production on the reported quantities by using the reported TRI production ratios. The Adjusted for Production numbers are adjusted to the base year production levels, thus providing a production-level comparison of current quantities to base year quantities. Please refer to the example on Page 9 for an additional explanation of Adjusting for Production.

II. 1997 TURA Data: By Chemical

Massachusetts facilities are required by TURA to report on chemicals according to type of use: "manufacture," "process," or "otherwise used." This information allows the public to know what chemicals are created in Massachusetts, incorporated into products, or used for ancillary activities such as cleaning. The terms are specifically defined under TURA as follows:

Manufactured – "to produce, prepare, import or compound a toxic or hazardous substance" (e.g., the unintentional manufacture of hydrochloric acid during combustion of fossil fuels or the intentional manufacture of a metal compound).

Processed – "the preparation of a toxic or hazardous substance, including without limitation, a toxic substance contained in a mixture or trade name product, after its manufacture, for distribution in commerce" (e.g., in the formulation of paints or coatings, any listed constituents are "processed;" in the manufacture of polystyrene, the styrene monomer is processed).

Otherwise Used – "any use of a toxic substance that is not covered by the terms manufacture or process and includes use of a toxic substance contained in a mixture or trade name product" (i.e., in the cleaning of parts).

Manufactured Chemicals

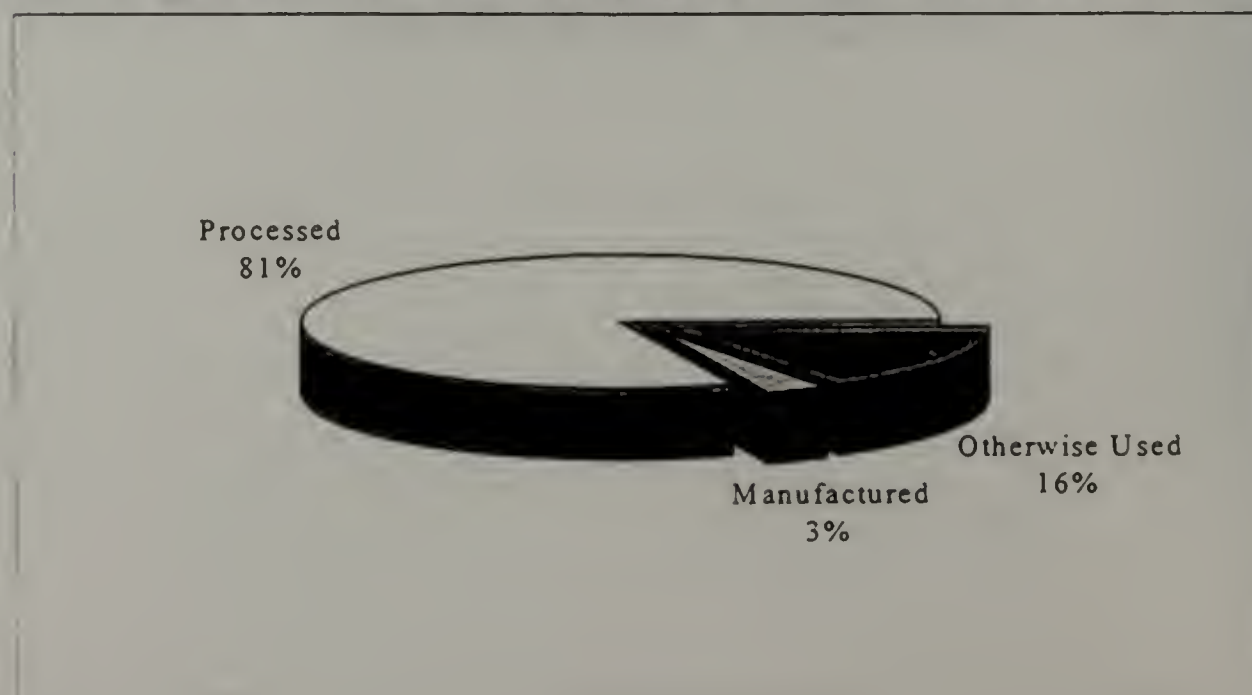
As shown below in Figure 10, there is very little manufacturing of TURA chemicals in Massachusetts. Chemicals reported as "manufactured" account for only 3% of the total statewide use. Approximately 70% of the total amount reported as manufactured is reported as being generated as byproduct.

This suggests that most of the chemicals reported as manufactured are "coincidentally manufactured," i.e., produced as a byproduct of some other activity. An example of this is the production of nitrate compounds as a result of wastewater treatment or the creation of acid gases in power generation.

Processed Chemicals

In Massachusetts, the predominant activity is "processing," where a listed chemical is incorporated into a product. Copper accounts for about 21% percent of the 956 million pounds of chemicals reported processed in 1997. The 205 million pounds of copper were used to make such products as electric wire, printed circuit boards, fuses, grinding wheels, jewelry and dyed fabrics.

Figure 10 – Chemical Use (does not include trade secret)



Otherwise Used Chemicals

The "otherwise used" category represents 16% of the 1.2 billion pounds of total statewide use reported in 1997 by all TURA filers. "Otherwise used" chemicals are involved in such ancillary activities as cleaning or providing the carrier solvent for paint application.

There has been, in fact, a dramatic reduction in "otherwise used" chemicals since 1994, when the remaining CERCLA (Comprehensive Environmental Response, Compensation and Liability Act, federal) chemicals were phased in. TURA filers reported a 25 million pound reduction in otherwise used chemicals, from 220 million in 1994 to 195 million in 1997.

Top 20 Chemicals

Looking at chemicals across the board in 1997, 187 chemicals were reported out of 1,420 TURA-listed chemicals. Of the 187, twenty chemicals accounted for 82% of the total use reported statewide. For some of these chemicals, trade secret claims have been made, so that Table 5 shows the reported quantities of the 1997 top 20 chemicals, excluding confidential business information.

Under DEP's trade secret procedures, aggregated information on the top 20 chemicals may be made public. The total use of the top 20 chemicals was 1.14 billion pounds (including trade secret information). Note that the sum of the total use data in Table 4 is less than 1.14 billion pounds because only non-trade secret quantities are presented in Table 4.

Of the 1997 top 20 chemicals used, two substances dominate: styrene monomer, which accounts for 36% of the total top 20, and copper, which amounts to 21% of the total. Styrene monomer is the building block for various plastics, while copper's predominant uses include the manufacturing of printed circuit boards and cable wire.

The 1997 top 20 chemicals generated as byproduct accounted for 88% of the total byproduct generated statewide or 121 million pounds (including trade secret information). Table 4 presents the total pounds of each of these chemicals.

Note that styrene monomer, which is the highest volume TURA chemical in Massachusetts, does not appear on the 1997 top 20 chemical byproducts. This is largely attributable to the efficiency of the process by which the monomer form of styrene is turned into plastic polymers. For styrene monomer, byproduct as a percent of total use is less than 1%, reflecting on efficiency in use of greater than 99%.

Copper, which is second in the top 20 chemicals in terms of use, is number four in terms of byproduct generation. Six percent of the total copper used is generated as byproduct. Nearly all of it, however, is recycled off-site.

In terms of the top 20 chemicals for byproducts, the top two are sodium hydroxide and toluene. Sodium hydroxide is the most widely used of the TURA chemicals in terms of the number of firms reporting it. Of the 509 facilities reporting under TURA, 215, or nearly 50 percent reported sodium hydroxide. Toluene, which is number two in terms of byproducts generated, is third based on the number of firms reporting it. Eighty TURA filers reported using toluene.

Table 5 - 1997 Top 20 Chemicals

Total Use <i>*These Quantities do not include Trade Secret</i>		Byproduct Generation <i>These quantities include Trade Secret</i>	
Chemical Name (CAS #)	Total Use (Lbs.)	Chemical Name (CAS #)	Byproduct Generation (Lbs.)
Styrene Monomer (1004-25)	359,830,258	Sodium Hydroxide (1310-73-2)	16,487,181
Copper (7440-50-8)	205,812,953	Toluene (1088-83)	14,984,604
Sodium Hydroxide (1310-73-2)	93,183,683	Sulfuric Acid (7664-93-9)	12,276,324
Hydrochloric Acid (7647-01-0)	44,746,314	Copper (7440-50-8)	11,569,849
Sulfuric Acid (7664-93-9)	44,169,206	Ethyl Acetate (1417-86)	10,863,806
Toluene (1088-83)	38,243,494	Acetone (6764-1)	10,401,308
Methanol (6756-1)	31,743,868	Methyl Ethyl Ketone (7893-3)	8,872,706
Methyl Ethyl Ketone (7893-3)	17,767,006	Methanol (6756-1)	6,480,986
Sodium Hypochlorite (7681-52-9)	17,076,118	Hydrochloric Acid (7647-01-0)	6,170,352
Potassium Hydroxide(1310-58-3)	16,571,653	Copper Compounds (1015)	4,983,770
Zinc and Compounds (1039)	15,614,978	Nitric Acid (7697-37-2)	3,246,014
Acetone (6764-1)	15,556,318	Nitrate Compounds (1090)	2,537,577
Ammonia (7664-41-7)	13,862,171	Ammonia (7664-41-7)	2,140,836
Copper Compounds (1015)	13,656,697	Dichloromethane (7509-2)	1,978,099
Ethyl Acetate (1417-86)	12,270,828	Phosphoric Acid (7664-38-2)	1,825,565
Methyl Methacrylate (8062-6)	12,138,613	Dimethylformamide (6812-2)	1,753,053
Methylenebisphenyl (1016-88)	10,877,927	Acetic Acid (6419-7)	1,295,961
Lead Compounds (1026)	9,669,415	Xylene(Mixed Isomers) (1330-20-7)	1,110,185
Phthalic Anhydride (8544-9)	9,456,581	Nickel and Compounds (1029)	1,077,959
Hexane (N-Hexane) (1105-43)	8,963,221	Trichloroethylene (7901-6)	967,030
*The following three chemicals appear in the Top 20 Chemicals Total Use list (above) when trade secret quantities are included: Butyraldehyde, Formaldehyde, Vinyl Acetate.			

One of three things can happen to a chemical. It can be consumed or transformed, as when acids are neutralized. The substance can be shipped as or in a product, like copper in printed circuit boards, or it can become a waste. Wastes are either treated on-site or transferred or released off-site.

Table 7 shows the top 20 chemicals shipped in product. The total of these chemicals was 531 million pounds or 84% of the total shipped in product in 1997. As with total use, copper and styrene monomer are the predominant chemicals shipped in product. Note that the sum of the top 20 chemicals shipped in product is less than 531 million pounds because only non-trade secret quantities are presented in Table 6.

In terms of transfers and releases, the top 20 chemicals accounted for a total of 49 million pounds, which represents 84% of the 1997 transfers and releases reported statewide. Copper and toluene are numbers one and two respectively. Nearly all of the off-site transfers of copper were to recycling. For toluene, 24% of the transfers and releases were to the air; 76% were transfers off-site for treatment, disposal or recycling.

Table 6 - 1997 Top 20 Chemicals

Shipped in Product <i>These quantities do not include Trade Secret</i>		TRI Transfers & Releases <i>These quantities include Trade Secret</i>	
Chemical Name (Cas #)	Shipped in Product (Lbs.)	Chemical Name (Cas #)	Transfers & Releases (Lbs.)
Copper (7440-50-8)	193,849,466	Copper (7440-50-8)	12,155,806
Styrene Monomer (1004-25)	78,907,719	Toluene (1088-83)	5,524,783
Sodium Hydroxide (1310-73-2)	38,601,843	Copper Compounds (1015)	4,922,221
Methanol (6756-1)	27,291,375	Acetone (6764-1)	2,872,895
Toluene (1088-83)	23,164,890	Hydrochloric Acid (7647-01-0)	2,819,060
Potassium Hydroxide (1310-58-3)	12,600,155	Nitrate Compounds (1090)	2,592,356
Zinc and Compounds (1039)	12,594,887	Methanol (6756-1)	2,534,265
Sodium Hypochlorite (7681-52-9)	11,065,495	Ethyl Acetate (1417-86)	2,383,898
Methylenebisphenyl (1016-88)	10,877,927	Methyl Ethyl Ketone (7893-3)	2,370,785
Acetone (6764-1)	8,904,770	Dichloromethane (7509-2)	1,824,534
Methyl Ethyl Ketone (7893-3)	8,691,081	Ammonia (7664-41-7)	1,390,828
Hexane (N-Hexane) (1105-43)	7,959,592	Sodium Hydroxide (1310-73-2)	1,273,586
Copper Compounds (1015)	7,764,323	Nickel and Compounds (1029)	1,074,704
Lead Compounds (1026)	7,159,260	Trichloroethylene (7901-6)	870,908
Ethylene Glycol (1072-11)	6,615,127	Zinc and Compounds (1039)	855,203
Glycol Ethers (1022)	5,890,846	1-Methyl-2-Pyrrolidone (8725-04)	692,942
Di (2-ethylhexyl)-Phthalate (1178-17)	5,520,134	Formaldehyde (5000-0)	642,286
Antimony Compounds (1000)	5,164,446	Ethylene Glycol (1072-11)	617,387
Formaldehyde (5000-0)	5,125,587	n-Butyl Alcohol (7136-3)	606,688
Sulfuric Acid (7664-93-9)	4,936,268	Xylene(Mixed Isomers) (1330-20-7)	563,400
The following chemical appears in the Top 20 Chemical Shipped in Product list (above) when trade secret quantities are included: Ethyl Acetate.			

III. 1997 Significant Industrial Sectors

The following series of figures represent the results of analyzing the 1997 TURA Information as reported by industrial sector. Under TURA, the firms that must report include those in the Manufacturing Standard Industrial Classification (SIC) codes (20-39 inclusive) and those in SIC codes 10-14, 40, 44-51, 72, 73, 75 and 76.

The sector with the most firms, Chemicals & Allied Products, accounts for over half of the statewide total chemical use (manufactured, processed and otherwise used). This sector is a diverse group of industries, which includes companies that manufacture or formulate adhesives, paints, pharmaceuticals, and plastic materials and resins. Approximately 46% of the total chemical use for this sector is attributable to one chemical, styrene, used in the manufacture of polystyrene and other plastics.

After Chemicals & Allied Products, the Primary Metals sector is the next largest user, accounting for 13% of total statewide use. The 55 firms in this sector engage in such production processes as heat treating, drawing, forging, casting and coating of metal products. Some 80% of their chemical usage is attributable to copper.

The third largest sector in terms of chemical use is the Wholesale & Non-Durable Goods sector. The 10 firms in this sector are primarily engaged in chemical distribution and they account for some 9% of total statewide use.

The 49 firms in the Rubber & Plastics sector account for 6% of chemical use. The Electronics (60 firms) and Paper & Allied Products (42 firms) sectors each used 3% of the total statewide amount. The Instruments sector, with 24 firms reporting, accounted for 2% of chemicals, leaving the balance of statewide use (7%) to a variety of sectors.

Figure 11 – 1997 Chemical Use (by industrial sector)

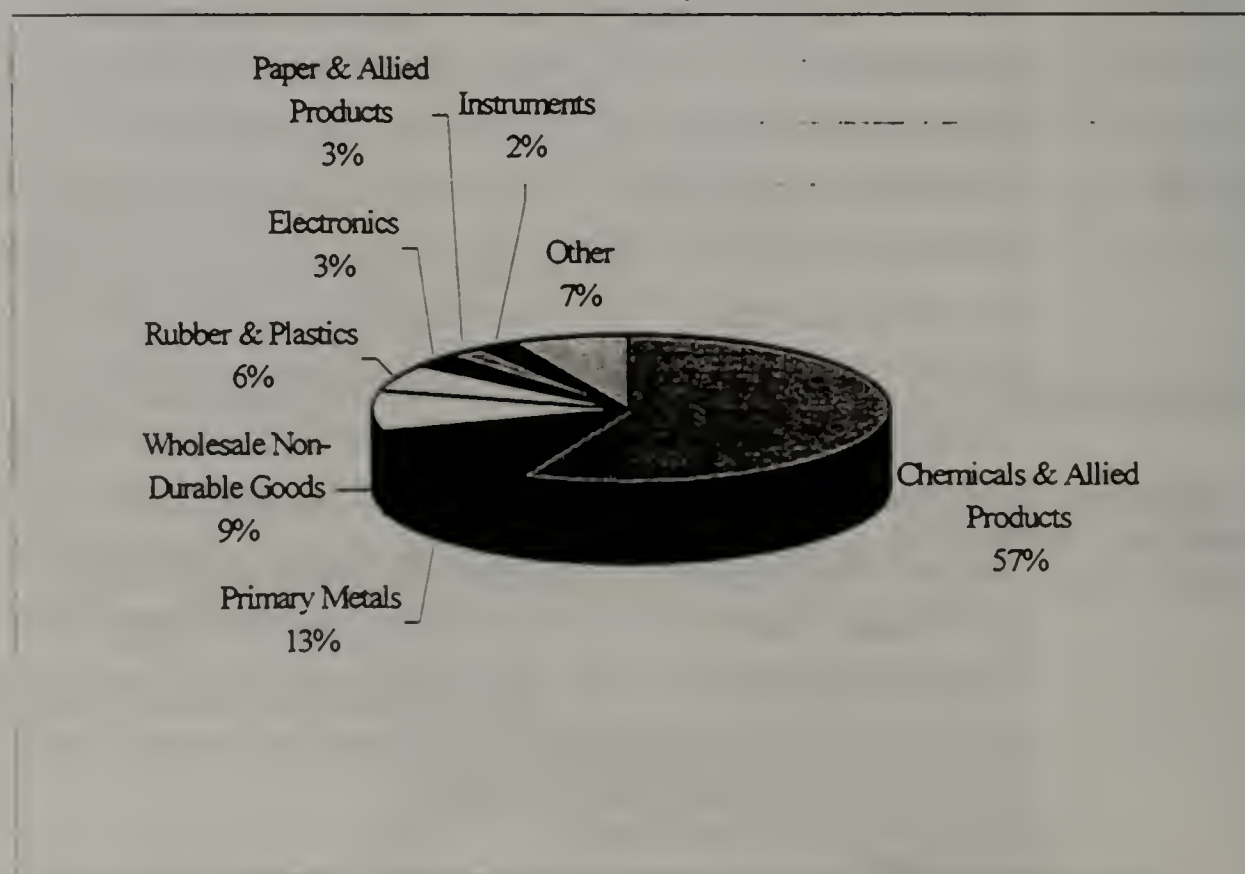


Figure 12 below shows byproduct generation by industrial sector. Note that while the Chemical & Allied Products sector accounted for 57% of total statewide use, this industry produced only 17% of the total byproduct.

In contrast, Paper & Allied Products, which represented 3% of total use, accounted for 17% of the byproduct generated. The use of toluene, acetone and ethyl acetate (key ingredients in various coating mixtures) accounts for 61% of the total byproduct generation from the 42 firms in this industry.

The Primary Metals sector, accounted for 12% of total byproduct generated, and copper sent off-site for recycling represents some 59% of that byproduct. The Instruments sector generated 11% of total byproducts in 1997, while using only 2% of the statewide total chemicals. That sector contains 24 firms, which make very different products, including medical devices, photographic film, automotive thermostats, and pen caps.

Other major industries that generated byproduct include: Fabricated Metals (9%), Textiles (8%), and Rubber & Plastics (8%). The remaining 18% of byproduct was generated by a variety of sectors.

Figure 12 – 1997 Byproduct Generation (by industrial sector)

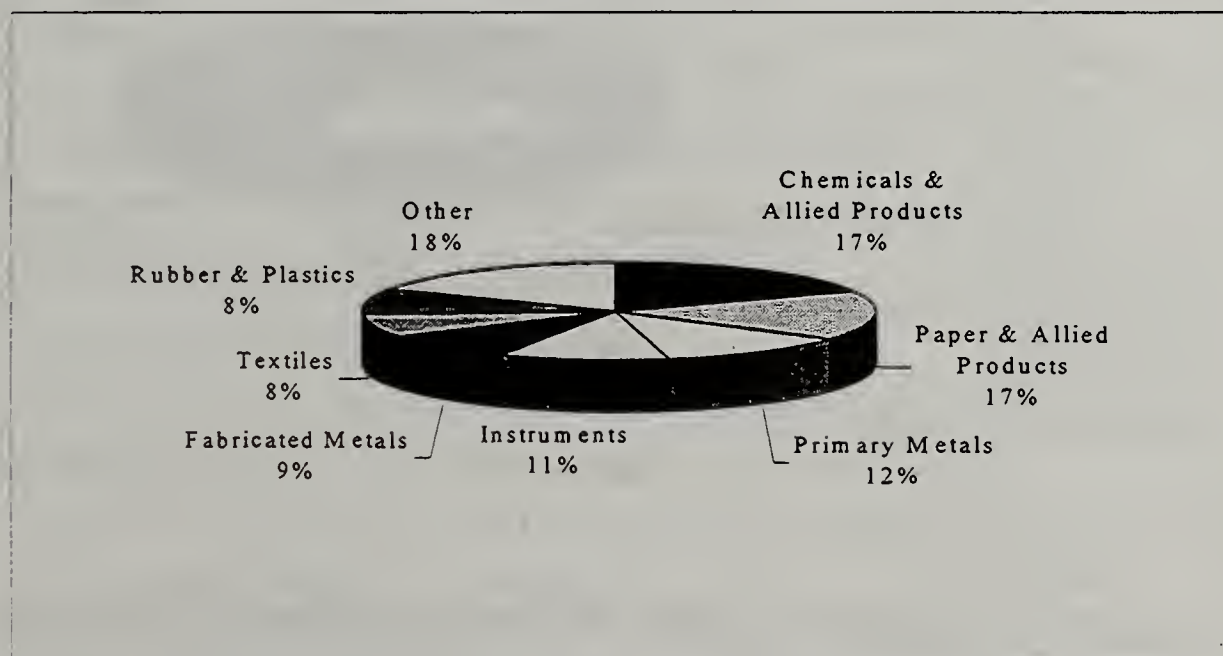


Figure 13 and Figure 14 show on-site releases to the environment and off-site transfers by industrial sector respectively.

With regard to on-site releases to the environment, the Electric, Gas and Sanitary Services sector is the largest source of such releases under TURA. The 37 firms in this sector accounted for 30% of all on-site releases. Stack gases containing hydrochloric acid represent 79% of the releases from this sector, which includes power plants. Note, by contrast, that the Electric, Gas and Sanitary Services sector accounted for such a small proportion of statewide use and byproduct that it is included in the "other" category in Figure 11 and Figure 12.

The Chemical & Allied Products sector, which represents a little over half of total statewide use, accounted for 13% of total on-site releases and 24% of off-site transfers. Paper & Allied Products generated 12% of total on-site releases and 7% of off-site transfers. The major chemicals involved for this sector are toluene, acetone and ethyl acetate.

Paper & Allied Products accounted for 12% of total on-site releases and 7% of off-site transfers. The 60 firms in the Electronics Sector generated 6% of the on-site releases and 10% of the off-site transfers.

The Rubber & Plastics sector and the Fabricated Metals sector each accounted for 9% of on-site releases. Their off-site transfers were such that they are included in the "other" category, which all together generated 7% of total off-site transfers.

Two sectors, Primary Metals and Instruments, accounted for 25% and 21%, respectively, of the off-site transfers. For the former, copper scrap sent off-site for recycling was responsible for 79% of the off-site transfers.

Figure 13 – 1997 TRI On-site Releases (by industrial sector)

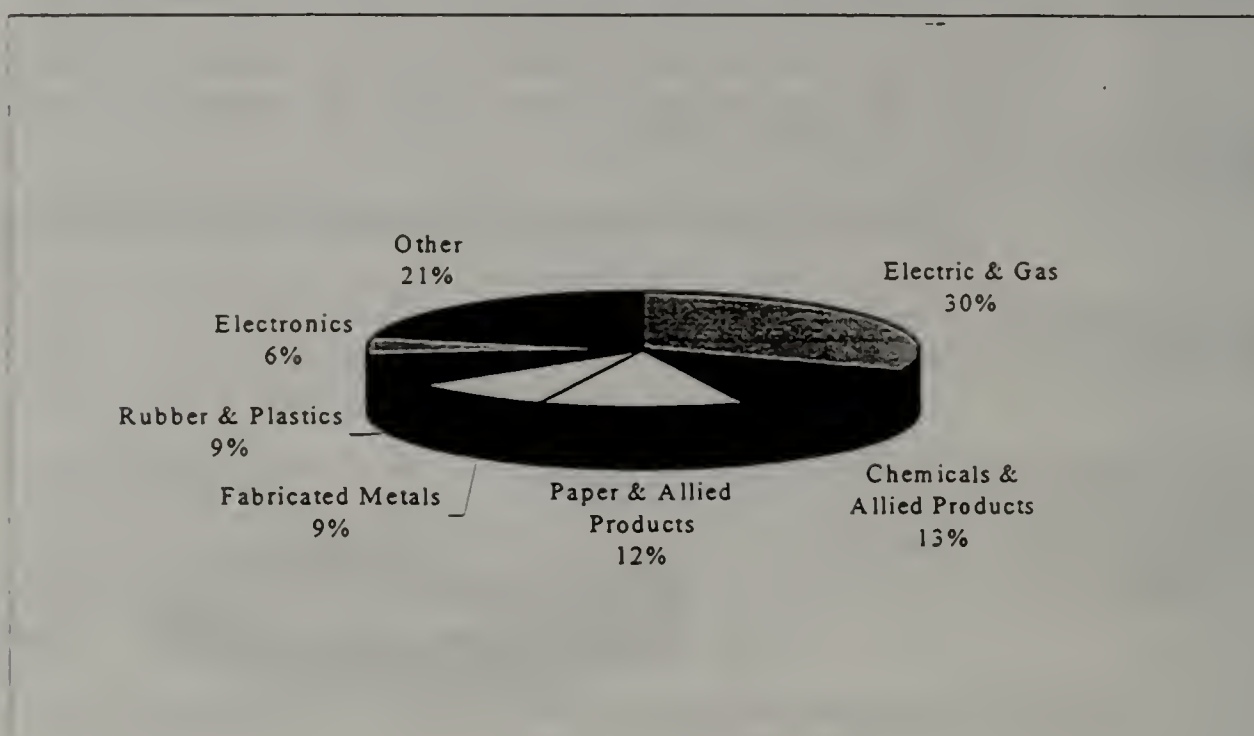
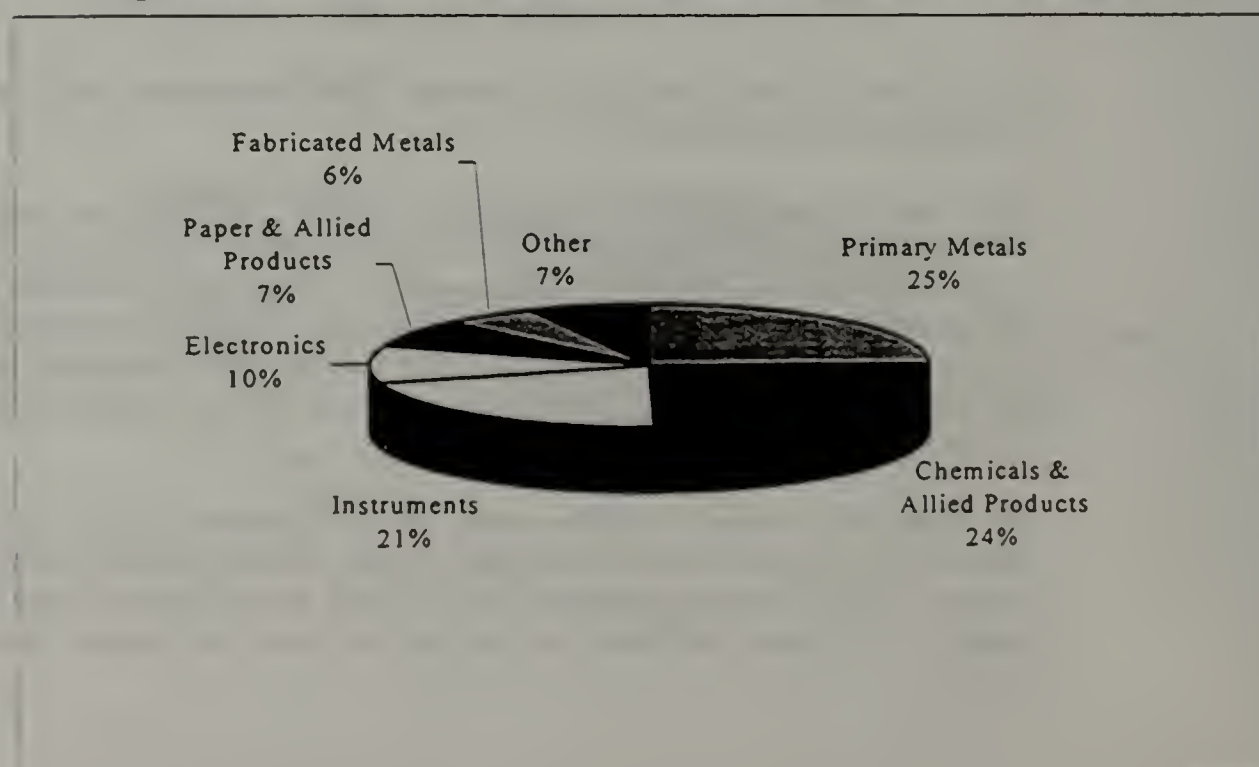


Figure 14 – 1997 TRI Transfers Off-site (by industrial sector)



IV. 1997 TURA Data: Major Facilities

The 10 facilities which showed the largest byproduct reduction from 1996 to 1997, and reported implementing TUR, are shown in Table 7.

While individual changes in production varied, the facilities either reported increased production (via their TRI production ratios) or reported substantially more byproduct reduction than could be attributed to reduced manufacturing activity. Overall, the production level of this group of facilities showed an increase in production levels over 1996. Thus, these reductions cannot be attributed to decreased production levels.

Table 7 - 1997 Top 10 Facilities with the Greatest Reduction in Byproduct Generation While Implementing Toxics Use Reduction (1996-1997)		
Company	Reduction in Byproduct (Lbs.)	TUR Techniques
1. Polaroid Corporation (Waltham-Main St.)	3,529,709	Product Reformulation
2. Solutia (Springfield)	1,555,806	Improved Operation & Maintenance
3. Avery Dennison Corp. (Framingham)	541,842	Product Reformulation
4. Novacor Chemicals, Inc. (Springfield)	491,531	Recycling, Reuse, or Extended Use of Toxics
5. Lepages, Inc. (Gloucester)	417,555	Input Substitution
6. Cranston Print Works (Webster)	348,160	Improved Operation & Maintenance
7. Plymouth Rubber Company (Canton)	304,300	Input Substitution
8. Precision Lithograining Corp. (South Hadley)	251,160	Product Reformulation
9. Allegro Microsystems (Worcester)	235,607	Input Substitution
10. Reflek Corp. (Fall River)	183,546	Improved Operation & Maintenance

The 1997 top 20 facilities (in terms of total use) used a total of 941 million pounds, which is 68% of the 1997 total use reported statewide. The 1997 top 20 facilities (in terms of byproduct generation) generated a total of 73 million pounds of byproduct, which is 53% of the 1997 byproduct generation reported statewide (*see Table 8*).

Table 8 - 1997 Top 20 Facilities
(Largest Quantity of Total Use and Byproduct Generation)

Total Use			Byproduct Generation		
Facility Name	Town	Total Use (Lbs.)	Facility Name	Town	Byproduct Generation (Lbs.)
Novacor Chemicals, Inc.	Springfield	238,519,668	Rexham Graphics, Inc.	South Hadley	10,214,102
Solutia, Inc.	Indian Orchard	135,107,006	Chemdesign Corp.	Fitchburg	8,154,319
American Polymers	Oxford	68,229,372	American Insulated Wire Corp.	Attleboro	6,612,691
American Insulated Wire Corp.	Attleboro	63,980,484	Flexcon Co., Inc.	Spencer	6,242,103
Boremco Specialty Minerals	Fall River	62,849,911	Texas Instruments	Attleboro	6,223,801
BASF Corp. - Polymers	Holyoke	57,120,000	Solutia, Inc.	Indian Orchard	5,758,364
Holland Co., Inc.	Adams	44,731,979	Polaroid Corp.	Waltham	4,518,793
Eastman Gelatine Corp.	Peabody	38,308,360	Eastman Gelatine Corp.	Peabody	3,719,218
Elite Chemicals	Ludlow	34,438,451	Crane & Co., Inc. Pioneer Mill	Dalton	2,343,775
American Flexible Conduit	New Bedford	31,905,815	Rodney Metals	New Bedford	2,303,272
General Cable	Taunton	30,441,827	Ideal Tape Co.	Lowell	2,293,027
Astro Chemicals, Inc.	Springfield	21,585,593	Venture Tape	Rockland	2,073,448
Texas Instruments	Attleboro	19,512,040	BBA Nonwovens Griswoldville Plant	Colrain	1,938,379
Ashland Chemical Co.	Tewksbury	15,733,248	Madico, Inc.	Woburn	1,745,226
Houghton Chemical Co.	Boston	15,151,893	Polaroid Corp.	New Bedford	1,551,070
TACC International	Rockland	13,450,462	Chemet Corp.	Attleboro	1,494,999
Firestone Building Products	Springfield	13,071,456	Polyclad Laminates	Millbury	1,445,141
AFC Cable Systems, Inc.	New Bedford	12,773,340	Altron	Wilmington	1,418,689
Monson Companies, Inc.	Leominster	12,145,546	New England Power Co.	Somerset	1,399,500
Chemdesign Corp.	Fitchburg	11,729,011	Anitec Printing Plates	Holyoke	1,391,884

The 1997 top 20 facilities (in terms of quantity shipped in product) shipped a total of 467 million pounds in product, which is 74% of the 1997 shipped in product reported statewide. The 1997 top 20 facilities (in terms of quantity of TRI transfers and releases) transferred and released a total of 36 million pounds, which is 61% of the 1997 TRI transfers and releases reported statewide (*see Table 9*).

Table 9 – 1997 Top 20 Facilities
(Largest Quantity of Shipped in Product
and TRI Transfers and Releases)

Shipped in Product			TRI Transfers and Releases		
	Town	Shipped in Product (Lbs.)	Facility Name	Town	Transfers and Releases (Lbs.)
American Polymers	Oxford	68,210,724	American Insulated Wire Corp.	Attleboro	6,613,433
Boremco Specialty Chemicals	Fall River	62,802,116	Texas Instruments	Attleboro	6,152,863
American Insulated Wire Corp.	Attleboro	57,363,298	Solutia, Inc.	Indian Orchard	4,074,429
Solutia, Inc.	Indian Orchard	36,198,300	Chemdesign Corp.	Fitchburg	3,761,085
American Flexible Conduit	New Bedford	31,905,815	Polaroid Corp.	Waltham	2,379,433
General Cable	Taunton	30,231,265	Rexham Graphics, Inc.	South Hadley	2,124,766
Elite Chemicals	Ludlow	25,891,348	New England Power Co.	Somerset	1,325,444
Astro Chemicals, Inc.	Springfield	20,548,498	Ideal Tape Co.	Lowell	984,913
Houghton Chemical Corp.	Boston	15,131,614	Altron	Wilmington	937,230
Ashland Chemical Co.	Tewksbury	15,125,858	New England Power Co.	Salem	906,586
TACC International	Rockland	13,412,172	Gould Electronics, Inc.	Newburyport	897,700
Firestone Building Products	Springfield	13,071,456	Judd Wire, Inc.	Turners Falls	670,630
AFC Cable Systems, Inc.	New Bedford	12,773,340	Montaup Electric Co.	Somerset	655,229
Monson Companies, Inc.	Leominster	12,133,383	The Duncan Group	Everett	628,546
Roma Marble, Inc.	Ludlow	10,317,212	Polaroid Corp.	New Bedford	609,144
Industrial Blast Coil Corp.	South Easton	9,797,199	Polyclad Laminates	Millbury	598,618
Shipley Co., Inc.	Marlborough	9,522,510	Waters Corp.	Taunton	583,160
Texas Instruments	Attleboro	9,318,100	Attleboro Refining Co., Inc.	Attleboro	582,480
Mohawk CDT	Leominster	6,872,756	Flexcon Co., Inc.	Spencer	565,048
Spalding Evenflo Co., Inc.	Chicoppe	6,861,810	Eastman Gelatine Corp.	Peabody	543,622

V. Conclusion

This report summarizes some of the information that has been gathered over the past eight years since the inception of TURA reporting in 1990. The efforts of Massachusetts industry have resulted in a 41% reduction in production adjusted byproduct over this time. While the original statewide goal of a 50% reduction in toxics byproduct generation between 1987 and 1997 cannot be determined because of lack of data in pre-TURA years, we would expect this goal to be met within the next 1 to 2 years. With toxics byproduct generation consistently falling over the past years, Massachusetts industry should exceed the 50% reduction goal. In addition to the substantial successes of industry in reducing toxics byproduct generation, Massachusetts industry has also been successful in reducing total use of chemicals, and reducing TRI on-site releases by 80% over the past years.

VI. Key TURA Terms: Definitions

Throughout this report many terms have been used. The definitions below are provided to assist the reader in understanding some of the key elements of TURA. Additional information regarding TURA and TRI, as well as general chemical information, can be obtained from the Internet web sites noted on the next page.

The terms and definitions below have been arranged in order of inputs and outputs. Chemicals that are used by companies are brought into the facility and are Manufactured, Processed or Otherwise Used. As a result of using these chemicals, a company has outputs that can include a product that is created for sale or byproduct or waste. The calculation of use and waste of chemicals is known as 'Materials Accounting'. Generally, the inputs equal the outputs, but there are circumstances in which a chemical is used in ways that result in an imbalance between inputs and outputs. These circumstances are most often the result of:

- 1) the chemical is consumed or transformed,
- 2) recycled on-site,
- 3) the product is held in inventory, or
- 4) the chemical is a compound.

TURA – Massachusetts Toxics Use Reduction Act of 1989 (MGL 211)

TRI – federal EPA Toxics Release Inventory

TRADE SECRET – the information identified as confidential by TURA filers. To protect confidentiality claims by Trade Secret filers, all trade secret data in this information release is presented in aggregated form. Aggregated data does not include the names and amounts of chemicals subject to claims of confidentiality.



CHEMICAL USE – amount in pounds of the manufacture, processing and otherwise use of a chemical. (Relabeling or redistributing a container of a toxic substance where no repackaging of the toxic substance occurs does not constitute use or processing of the toxic substance.)

MANUFACTURE – to produce, prepare, import or compound a toxic or hazardous substance.

PROCESS – the preparation of a toxic or hazardous substance, including without limitation, a toxic substance contained in a mixture or trade name product, after its manufacture, for distribution in commerce: a) in the same form or physical state, or in a different form or physical state, from that in which it was received by the toxics user so preparing such substance; or b) as part of an article containing the toxic or hazardous substance.

OTHERWISE USED – any use of a toxic substance that is not covered by the terms "manufacture" or "process" and includes use of a toxic substance contained in a mixture or trade name product.

TOTAL USE – the total quantity in pounds of TURA chemicals reported as manufactured, processed and otherwise used.

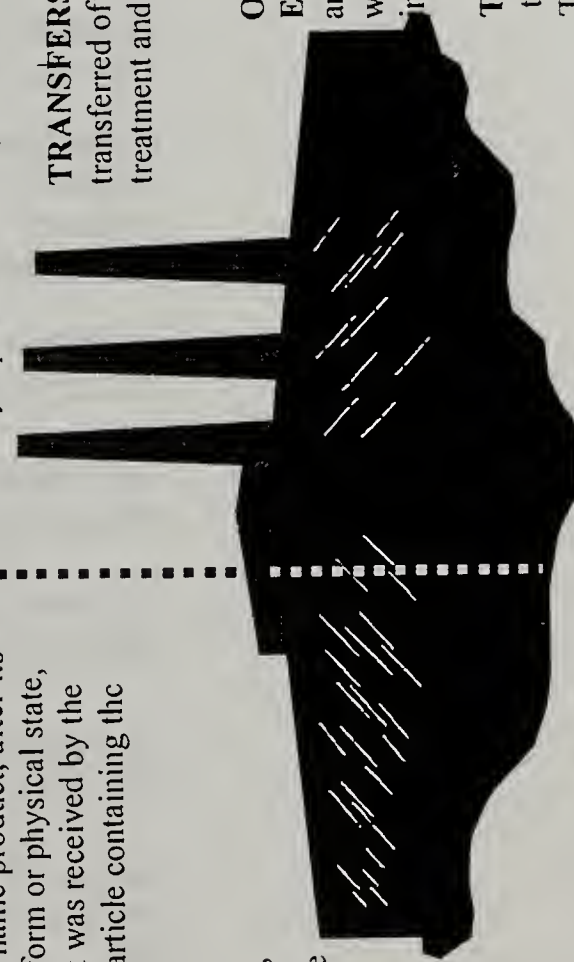
SHIPPED IN PRODUCT – the quantity in pounds of the chemical that leaves the facility as product.

BYPRODUCT – all non-product outputs of reportable substances generated by a production unit prior to handling, treatment, and release.

TRANSFERS OFF-SITE (TRI) – byproducts that are transferred off-site for energy recovery, recycling, treatment and disposal.

ON-SITE RELEASES TO THE ENVIRONMENT (TRI) – all byproducts that are released to the air, discharged to surface waters, on-site releases to land & underground injection wells.

TRANSFERS & RELEASES (TRI) – total transfers & releases reported under TRI.



For Information Regarding Chemicals, TURA and Pollution Prevention, the Following Web Sites Can Be Accessed:

Toxic Use Reduction Program, Massachusetts DEP (TURA)
<http://www.state.ma.us/dep/bwp/dhm/tura>

Toxic Use Reduction Institute (TURI)
<http://www.turi.org>

Office of Technical Assistance for Toxics Use Reduction (OTA)
<http://www.state.ma.us/ota>

Agency for Toxic Substances and Disease Registry
<http://atsdr1.atsdr.cdc.gov:8080/ToxProfiles/>

CambridgeSoft Chemfinder gives basic physico-chemical data and molecular structures for chemicals, and provides links to international data sources addressing specific chemicals.
<http://chemfinder.camsoft.com/>

Envirofacts, US EPA
<http://www.epa.gov/enviro/html/emci/chemref/index.html>

Environmental Chemicals Data and Information Network (ECDIN)
<http://ecdin.etomep.net/>

Environmental Defense Fund's (EDF) Scorecard web site
<http://www.scorecard.org/chemical-profiles/>

Global Information Network on Chemicals (GINC)
<http://db.hihs.go.jp/>

Integrated Risk Management Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment US EPA
<http://www.epa.gov/iris/>

TOXLINE. Free access to the National Library of Medicine's toxicology-specific database of abstracts, reference journal articles.
<http://www.medscape.com/misc/FormToxlineInfLive.html>

University of Akron Hazardous Chemicals Database. The Hazardous Chemicals Database provides physical data on chemicals and links to Department of Transportation safety guides that are valuable for emergency response
<http://ull.chemistry.uakron.edu/erd/>

